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Conservation inequality and the charismatic cat: Felis felicis

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ABSTRACT

Conservation resources are limited, making it impossible to invest equally in all threatened species. One way to maximise conservation gains is to focus upon those species with particular public appeal, using them to generate funding and support that could also benefit less charismatic species. Although this approach is already used by many conservation organisations, no reliable metrics currently exist to determine the likely charisma of a given species, and therefore identify the most appropriate targets for such campaigns. Here we use market research techniques on over 1500 people from five continents to assess the relative charisma of different mammals, which factors appear to drive it, and how these patterns vary between countries. Felids and primates emerged as highly favoured species for conservation, with the tiger (*Panthera tigris*) the top species by a wide margin. Using an information theoretic approach we develop models that successfully predict respondents' preferences across the entire sample, suggesting global commonalities in the attributes that people prefer for conservation. However, by analysing each country separately we are able to improve our models, thus highlighting the importance of identifying locally specific flagships for conservation. The most important attributes were body size and IUCN status, although the extent of baldness, whether the species was a potential threat to humans and whether the eyes were forward or side facing were also widely important. Several of the key attributes revealed in this study could be extrapolated to nearly all terrestrial mammals, paving the way for a standardised global identification of species likely to prove effective for future conservation campaigns. The public preferred species with which they had affinity and familiarity, and we discuss how these aspects could be increased to promote the under-achievers, whilst maximising the funding potential of the highly charismatic mammals. While the felids are widely regarded as a popular taxonomic group, the great extent to which they appealed to our respondents emphasises their potential as ambassadors for conservation. Indeed, the big cats were so highly rated that we might think of them as one, *Felis felicis:* a globally powerful flagship for conservation.

1. Introduction

While a sort of taxonomic egalitarianism might have it that all species are equal, it is clear that to most people some species are more equal than others. For example, while we might suspect that the man on the Clapham omnibus may value a

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gorilla (*Gorilla gorilla*) more highly than a house mouse (*Mus musculus*), it is less clear-cut, but still likely, that such differences are perceived even amongst closely related organisms, such as two species of felid. While such favouritism might be ethically inconsistent, it is likely to be highly relevant to practical conservation (Macdonald et al., 2006). This matters because, while Noah may have been determined to rescue at least one representative pair of everything, neither the public nor policy makers have the ability, let alone the inclination, to be so even handed. In order to raise funds, and to have the best chance of influencing political decision making, it is arguably important for conservationists and policy makers to understand which species are most valued by the public and why.

Conservation organisations have a long history of focusing their campaigns around single charismatic species, but it was not until the 1990s that the term 'flagships' for conservation began to attract interest in the conservation literature. Since then it has been much discussed and has undergone many reinterpretations (Caro and O'Doherty, 1999; Favreau et al., 2006; Heywood, 1995; Meffe and Carroll, 1997; Simberloff, 1998). A recent review of the concept defined flagship species as ''*a species used as the focus of a broader conservation marketing campaign based on its possession of one or more traits that appeal to the target audience*'' (Verissimo et al., 2011). The appropriateness and effectiveness of focusing conservation attention on a single species has been debated vigorously (Bowen-Jones and Entwistle, 2002; Caro, 2010; Favreau et al., 2006; Linnell et al., 2000; Small, 2012a,b). On the critical side, some authors have preferred an emphasis on ecosystem management (Simberloff, 1998), and others have illustrated the dangers of selecting a flagship species that is locally inappropriate (Linnell et al., 2000) or found that focusing on single species does not necessarily confer the best protection of other locally occurring species (Lindenmayer et al., 2014). On the positive side, others have found that the presence of a charismatic flagship species increases the public's engagement with conservation issues (Smith and Sutton, 2008) and their willingness to pay for conservation (Kontoleon and Swanson, 2003; White et al., 2001). Governments and NGOs have also repeatedly and successfully used flagship species as marketing tools for leveraging political influence and funds for wider conservation (e.g. Dietz et al., 1994, Loveridge, 2014 and Veríssimo et al., 2009). Much of the debate about flagship species stems from different interpretations of the term (Barua, 2011), so in their definition, Verissimo et al. (2011) deliberately focus on their use as marketing tools. They avoid using the term 'charisma' because perceptions of charisma are likely to differ between stakeholder groups and because it is potentially susceptible to manipulation by marketers. However, charisma and attractiveness have been widely cited as being key traits that might contribute to public perceptions of a species (Lorimer, 2007; Small, 2012a), and indeed Veríssimo et al. (2014) found 'attractiveness' to be a significant determinant in identifying flagship bird species in Brazil.

In what some regard as the seminal paper on the subject, Lorimer (2007) identifies three facets of non-human charisma, namely ecological, aesthetic and corporeal charisma. Ecological charisma broadly relates to the 'detectability' of a species—in other words factors such as the size, circadian rhythm and elusiveness of species that are likely to bring it to the attention of humans. Aesthetic charisma refers to the aesthetic characteristics of a species' appearance or behaviour, and corporeal charisma relates to a deeper emotional attachment that can be understood in terms of epiphanies (such as a childhood encounter) or the accumulation of expert knowledge of a species. In line with these ecological and aesthetic facets of charisma there appear to be some commonalities amongst the species that people find attractive—for instance, species chosen as flagships are typically large, warm blooded, endangered and predatory with forward facing eyes (Caro and O'Doherty, 1999; Clucas et al., 2008; Courchamp et al., 2006; Dietz et al., 1994; Johnson et al., 2010; Smith et al., 2012). Further, zoological gardens trade on the ability of their collections to attract visitors, and consequently zoo species are likely to be large, attractive and even often of lower conservation priority than their close relatives not held in zoos (Frynta et al., 2013; Martin et al., 2014). However, despite the fact that there are obvious biases in people's attitudes, driven in part by the ecological and aesthetic components of charisma, there are currently no reliable metrics that objectively rate or predict which attributes might contribute to people's preferences. It is also important to note that a species' perceived attractiveness might also be affected, positively or negatively, by cultural or religious influences (Dunham, 2006; Gosler et al., 2013; Richards, 2000), or by positive or negative interactions with a species—one man's valued photo opportunity might just have eaten another man's livelihood.

Another key element of the flagship species debate is that any species selected as a flagship needs to be both relevant to the conservation issue and appropriate for to the intended recipients of the campaign (Bowen-Jones and Entwistle, 2002; Douglas and Veríssimo, 2013; Linnell et al., 2000). Nevertheless, many large international NGOs (WWF, RSPB, Greenpeace etc.) continue to invest substantial funds on broad based campaigns aimed at improving general attitudes towards environmental issues, as well as attracting funding and recruiting new members. These campaigns aim to reach as wide a selection of society as possible and can be seen in magazines, newspapers and on everything from the sides of buses to cans of cat food in cities around the world, and a single campaign can raise many hundreds of thousands of dollars (WWF, 2014).

To some extent marketing firms already know which species people like: Jaguar cars, Tusker beer, Lynx aftershave, Camel cigarettes and Puma sports clothing are all powerful commercial icons, and the giant panda (*Ailuropoda melanoleuca*), polar bear (*Ursus maritimus*), lion (*Panthera leo*) and tiger (*Panthera tigris*) are all frequent stars of conservation marketing campaigns. However determining differences in people's preferences towards different species is not always intuitive and there are over 5000 species of terrestrial mammal, with astonishing variations in morphology, from Kitti's hog-nosed bat (*Craseonycteris thonglongyai*), at 2 g to African elephants (*Loxodonta africana*) at 6000 kg, and from subterranean naked molerats (*Heterocephalus glaber*), to flying Malayan colugos (*Galeopterus variegatus*). Given that people's attitudes towards species are also likely to be heavily influenced by context and familiarity, we expect preferences to differ regionally and between people with different experiences of interacting with wildlife. These factors are likely to influence people's decision-making about conservation, arguably as much as technical evidence pertaining to particular conservation issues. Here, we define charisma as how attractive species are, relative to each other for conservation, as perceived by our respondents and investigate which species have the highest appeal, and why.

To explore mammalian charisma we used photographs of terrestrial mammals to investigate whether our respondents preferred the conservation of certain species above others and assessed whether these preferences were regionally consistent. We then examined whether underlying factors, such as specific physical attributes, could be used to predict charisma, as well as which species were ranked as more or less charismatic than would be expected on the basis of those factors alone. By understanding which factors appear to determine our respondents' attitudes to conservation, we provide a method to predict charisma across all mammals, and therefore help identify which species are likely to be effective flagships for future conservation campaigns.

2. Methods

Following the entreaty of Verissimo et al. (2011) for greater collaboration between conservationists and market research professionals, we used industry standard, market research techniques usually employed for the exploration of human preferences of commercial products, to inform our study design and data collection protocols. The survey was designed in collaboration with, and conducted by market-research professionals (Touchstone Partners Limited http://www.touchstonepartners.co.uk) allowing us to make the most of their extensive professional experience in survey design. Touchstone Partners coordinated recruitment of respondents through proprietary market research panels.

100 photographs of terrestrial mammals representing 25 orders and 69 families were presented in pairs to over 1500 participants from 5 countries. For each pair of photographs, the respondents were asked the strength of their preference between the two species in the context of priorities for conservation. We used paired conjoint analysis (Green and Wind, 1975; Green and Srinivasan, 1978) to rank all 100 photographs in order of people's preferences. Each photograph was described by 15 descriptive attributes, which we analysed post hoc to explore if any could be identified as important in driving people's preferences.

Prior to final delivery, several naïve volunteers from both Touchstone Partners and the Wildlife Conservation Research Unit tested the survey for content and ease of use. Comments from these volunteers were fed back into the survey design and used to improve the clarity of the questions, as well as the overall accessibility of the survey.

2.1. Survey design and delivery

In order to reflect our interest in broad based international conservation campaigns, we targeted our survey at the people most likely to be targeted by such campaigns—in other words a subset of society focused around the moderately affluent middle classes, politically engaged, and who we felt were most likely to either donate to or be members of conservation organisations. In order to achieve this, the survey was presented online in 5 different countries (UK, USA, India, South Africa and Australia) with levels of internet penetration ranging from 41% (South Africa) to 81% (UK). Conducting the survey online, biases the respondents towards affluence but may also increase the likelihood that they were politically engaged and have views and political leverage regarding environmental matters.

In total, the survey was taken by 1536 respondents aged 18–64 in 5 sub-samples (Australia: $n = 303$, India $n = 310$, South Africa $n = 311$, UK $n = 305$, USA: $n = 307$). Practical considerations meant that the survey was presented in English, and so we selected five English speaking countries with obvious differences in their mammalian fauna in order to test whether these regional differences influenced the attitudes of the respondents. While familiar with surveys, panellists are not contacted for surveys so frequently that they may be judged to have become unrepresentative of the wider population. Participants were asked to provide simple demographic information (age, sex, occupation) before viewing 25 pairs of images to establish their preferences between different mammals. Each participant was also asked to rate their familiarity with, and affinity for, a further selection of 25 photos. Across all regions the sex ratio of our respondents was 55.1% female with a mean age of 41.3 years for both sexes (♀ SD = 13.5, ♂ SD = 13.3). Demographics varied only slightly between countries however India was the only country where respondents were more likely to be male (24.8% ♀), the mean age of Indian respondents was also substantially lower than for other regions (35.0 for both sexes; Table 1). 28.1% of respondents were currently, or have been, members of a conservation organisation, 54.9% currently, or have previously donated to a wildlife conservation charity, 71.0% worry about conservation issues, and 75.8% believe that wildlife conservation should be a top priority for society (Table 1).

The total of 100 images was selected for practical reasons by trading-off the desire to include as many species as possible with factors such as cost, the amount of time people could be expected to devote without their attention waning, and the need for each image to be seen a sufficient number of times by members of each sub-population (300 from each of five countries) to deliver adequate analytical power. We designed our survey to take approximately 15 min, a duration that our market research partners have found to be optimal for online surveys (T. Baker pers comm) and comfortably within the 20 min advised by Cape (2010), and in line with Galesic and Bosnjak (2009) who found that both starting and completion rates were lower for surveys of 20 min and above. With a total of 100 images, and with each respondent viewing 25 pairings, we were able to ensure that each image would be seen on average 150 times in each sub sample of 300 participants.

Table 1
Demographics of survey respondents.

	Australia	India	South Africa	UK	USA	All regions
Total respondents	303	310	311	305	307	1536
n (♀)	188	77	194	198	190	847
n (♂)	115	233	117	107	117	689
% (♀)	62.0	24.8	62.4	64.9	61.9	55.1
Mean age (♀)	44.2	35.0	40.3	37.1	46.3	41.3
SD age (♀)	13.1	10.8	12.0	14.6	12.5	13.5
Mean age (♂)	46.1	35.0	41.6	46.1	44.6	41.3
SD age (♂)	12.7	11.6	12.2	13.9	13.1	13.3
% who are currently, or have been, a member of a conservation organisation	28.7	27.7	25.4	28.9	30.0	28.1
% who do currently, or have, donated to a wildlife conservation charity	56.8	49.0	63.0	55.4	50.5	54.9
% who worry about wildlife conservation issues	65.3	79.7	81.4	61.0	67.1	71.0
% who agree that wildlife conservation should be a top priority for society	71.6	86.1	87.1	63.9	69.7	75.8

2.1.1. *Paired conjoint test*

The survey used a standard pair-wise trade-off technique which was analysed using conventional conjoint analysis (Orme, 2005). Each respondent was shown 25 pairs of randomly selected mammalian species in a web-based presentation and asked to indicate their preference between them in the context of priorities for conservation, using a balanced five point semantic Likert scale that ran from left to right under the selected pair of pictures (Prefer completely/Prefer/Prefer Neither/Prefer/Prefer completely) (Malhotra, 1996; Oppenheim, 1992). Each image was shown only once, so that each respondent saw a randomly selected set of 50 of the 100 mammals.

2.1.2. *Familiarity and affinity test*

Having completed the 25 paired choices, each respondent was then shown a separate, random selection of 25 photos (viewed one at a time, as illustrated in Fig. A.1 (Appendix A)). For this exercise, each of the 100 mammal photos was randomly assigned to one of four sets of 25. One of these sets was then assigned, at random, to each respondent who was asked to record, for each photo (a) how familiar they were with the subject (familiarity) and (b) how much they liked the subject (affinity) (both on a 5 point semantic scale Osgood et al., 1957).

The entire survey took a median time of 14:28 min to complete. The pairwise comparisons took a mean of 6:50 min (standard deviation = ±15:25 min). Decision times for each pair varied hugely, from 0.5 s for one pair to 3 h 40 min. Surveys completed in <5 min (i.e. in less than 1/3 of the median time taken—termed by the market research industry as "speeders"), of which there were 10, were excluded altogether. We did not exclude respondents taking an unusually long time to complete the survey as we could not distinguish the thoughtful from the distracted. Time to make a preference did not predict the score given to a species ($F_{1,\ 38\,398} = 0.001$, $P = 0.971$). Respondents who repeatedly clicked the same response option with no evidence they considered their responses each time ("flatliners") were also excluded, although these were all speeders and no further respondents needed to be removed. 71% of respondents reported that they enjoyed the survey "a lot" while only 4% reported negative feeling towards the survey, indicating that the vast majority of respondents were positively engaged.

2.2. *Selection of species*

We selected 100 photographs of terrestrial mammals for inclusion in our survey. Terrestrial mammals were selected for their taxonomic representativeness, at the level of the family, and to maximise the diversity of physical morphs. Following the taxonomy in Macdonald (2009) there are 132 families of terrestrial mammal (2 Monotremata, 20 Marsupialia and 110 Eutheria). Although taxonomically distinct, some families contain species of such similar appearance that they are unlikely to be viewed differently by the general public (for example, families within both the microchiropteran and megachiropteran bats). Consequently, we did not include families within orders that duplicated morphs, resulting in a sample of 69 families of distinct appearance. At least one species from each of these families was selected, choosing examples that illustrated the diversity of morphs within families and the whole class Mammalia. In some families this resulted in multiple representatives—for example in the Australian carnivorous marsupials (Dasyuromorphia) the Tasmanian devil (*Sarcophilus harrisii*), western quoll (*Dasyurus geoffroii*), numbat (*Myrmecobius fasciatus*) and swamp antechinus (*Antechinus minimus*) were deemed so morphologically different to justify separate inclusion. Whereas in other cases the apparent evolutionary convergence on morphs within Mammalia led to species from different families representing each other. For example, the North American river otter (*Lontra canadensis*) was selected as one of the representatives of the family Mustelidae, but was also deemed a good morphological representative of the giant otter tenrec (*Potamogale velox*). The European hedgehog (*Erinaceus europaeus*) also provides a good morphological representation of the greater hedgehog tenrec (*Echinops telfairi*). Thus the order Tenrecidae was only represented by the highland streaked tenrec (*Hemicentetes nigriceps*), which was distinctive from the other mammals in the 100-strong sample.

In addition to one representative species per family, and building on our earlier analyses of felids and primates to function as umbrellas for each other (Burnham et al., 2013; Macdonald et al., 2013), we selected additional representatives from these two orders, which capture the attention of a wide public. Additionally while the primates selected displayed a wide range of morphologies, felids have a comparatively uniform body-type; thus allowing us to gain greater resolution into people's attitudes towards distinctive body and facial markings by presenting respondents with a several species that have a similar body form except for their pelage. This brings the total number of Carnivora to 27 (with 9 felids, including both the melanistic and the common forms of the leopard (*Panthera pardus*), 5 canids and 4 mustelids) and of primates to 13 (including 8 anthropoids, 8 Haplorrhine, 4 Strepsirrhine and 1 Lorisidae). Appendix B gives a full list of species used in the 100 photographs.

2.3. Selection, labelling and categorisation of photos

Images were selected using the criterion of a clearly visible single adult, and wherever possible were shown in the most natural setting possible. Following Takahashi et al. (2012) and to minimise possible biases due to differences in the photographs, we selected photos in which the mammal was positioned broadside to the camera, with its face visible but eyes not forcefully engaging the photographer. For species with sexual dimorphism, the more striking sex with the more exaggerated trait was selected on the assumption that these might be linked to charisma. For example, the male lion was selected for its mane and the male mandrill (*Mandrillus sphinx*) for its colourful facial markings. Each image incorporated the common English name of the species, an indication of its size (by comparison with a human silhouette or portion thereof), and its IUCN Red List status (see Appendix A for annotated examples).

In order to minimise potential biases arising from the aesthetic qualities of the photos (composition, saturation contrast etc.) we endeavoured to select images that were as comparable as possible, however image quality was inevitably poorer for some of the less frequently photographed species. In order to account for these possible biases, an independent panel of 11 volunteers scored all images on their photographic qualities, and this value was included as an attribute in our analysis.

2.4. Data processing

2.4.1. Species preference score

During each paired test, each mammal was assigned a score: "Prefer completely" = 2, "Prefer" = 1, "No preference" = 0, "Prefer other" = −1, "Prefer other completely" = −2. If one photo in the pair was "Preferred completely" it was scored 2, and the other photo in the pair would be scored −2, so for each pair the sum of scores given totalled 0. From this, the total preference score for each mammal was calculated by summing its scores across the whole sample. As each mammal was seen by a slightly different number of people, the scores were made proportional to the number of times it was seen. This average preference score was the basis of producing an overall rank for all 100 mammalian images. For example, the tiger was seen 774 times in total and the sum of all its pairwise scores was 870, thus it has a final preference score of 1.124 (870/774 = 1.124).

To test for position bias, each species' preference score was compared for the occasions when it was presented on the right or left of the pairing. The species preference scores generated from the right and left positions were highly and significantly correlated ($r = 0.980$, $t_{2,98} = 48.9379$, $p < 0.001$), indicating that there was no position bias.

2.4.2. Attribute scores

Each mammal image was classified according to a list of 15 attributes selected to reflect features known (e.g. eye position Smith et al., 2012) or suspected (e.g. furriness or baldness) to affect people's reactions. To accommodate variation in people's perceptions of these attributes, each of the 100 images was independently scored by the authors and a further 6 participants ($n = 11$). The scores were tabulated, and the modal value for each attribute was accorded to each species, but not displayed to the survey participants. The purpose of these attributes was to identify any characteristics that might be associated with high or low preference scores. These attributes included some that were generally unambiguous (e.g. forward- or lateral-facing eyes, strident black-and-white patterning, bright colouration) and others that were more subjective (e.g. furriness or striking physical appearance). In addition, each photo was rated for aesthetic quality to allow us to gauge the importance of the photography in influencing people's preferences. The list of these attributes is given in Table 2. They were selected to cover all three of Lorimer (2007)'s facets of non-human charisma, and reflected many of the character traits that have been mentioned as possible determinants of charisma in the literature (see Table 2).

2.4.3. Model averaging

The survey respondents' overall preference score for each species (hereafter response) was normally distributed (Shapiro–Wilk normality test W = 0.978, p-value = 0.0981) and was analysed relative to the 15 attributes in linear models (lm). The full model included IUCN status, ED score, diet, body size, human threat, activity pattern, striking appearance, armour, facial markings, body markings, colouration, eye position, fluffiness, photo quality and baldness as categorical fixed effects. The levels within each attribute are detailed in Table 2.

We used an information-theoretic approach to compare models that related the various attributes to the average preference scores each mammal accrued. The 'dredge' function of the 'MuMIn' function in R Version 3.0.3 was used to generate a set of candidate models with combinations of the terms in the full model.

Table 2
Full list of attributes and levels ascribed to each species.

Attribute	Levels	References
IUCN status This survey was intended to explore attitudes towards species in the context of conservation marketing. We therefore included five IUCN Red List categories as a measure of conservation priority. Rarity also appears to be important in people's attitudes towards species with some studies finding that people ascribe increased value to rare species, while others found that zoos (which trade on animal charisma) often stock species of lower conservation priority.	LC NT VU EN CR	Courchamp et al. (2006), IUCN (2014) and Martin et al. (2014)
ED score As with IUCN score, Evolutionary Distinctiveness was included as a measure of conservation priority. These were divided into 3 levels to reflect species of high, medium and low evolutionary distinctiveness.	<20 20–40 >40	Isaac et al. (2007)
Diet Traditionally flagship species have frequently been carnivorous, and so we test whether diet affects people's attitudes towards a species.	Carnivore Carnivore and Scavenger Herbivore Insectivore Omnivore	Caro (2010), Clucas et al. (2008), Macdonald (2009) and Myers et al. (2015)
Body size Size arguably affects the detectability of the species and thus it is ecological charisma. In addition traditional flagships have tended to be large species including the elephant, polar bear and tiger.	<1 1–10 10–20 20–40 40–100 100–800 >800	Lorimer (2007) and Macdonald (2009)
Human threat It has been proposed that humans may have an evolutionary predisposition to be attentive towards, and thus affected by species that may have been likely to harm them in their evolutionary history. By including this variable we test whether this has an impact on people's attitudes to species. Species were classified as being a potential threat to humans if they were either a member of the order Carnivora weighing >50 kg, or if they weighed >100 kg and had documented evidence of causing human fatalities.	Not a threat to humans Threat to humans	Kruuk (2002), Mungall (2007) and Woodroffe et al. (2005)
Activity pattern Activity pattern arguably affects the detectability of the species and thus it is ecological charisma. People are more likely to be positively disposed to species that share a similar circadian rhythm.	Crepuscular Crepuscular–Nocturnal Diurnal Nocturnal Variable	Lorimer (2007), Macdonald (2009) and Myers et al. (2015)
Striking appearance This term was included to try and capture the 'je ne sais quoi' or 'oddness' that some species appear to posess (such as perhaps the aye-aye (*Daubentonia madagascariensis*)).	Not striking Striking	Scored by 11 separate respondents prior to survey
Armour Many species poses impressive ornamentation, tusks, horns or antlers, while others have distinctive defensive armour. This term was included to see if these distinctive characteristics influenced people's preferences.	None Tusks Horns or antlers Scales or carapace Claws Spines or spikes	Scored by 11 separate respondents prior to survey.
Facial markings Facial markings are often used to exaggerate facial traits such as large eyes, and may contribute to aesthetic charisma	None Some Extreme	Scored by 11 separate respondents prior to survey.
Body markings Coat patterns can be eye catching and may contribute to aesthetic charisma.	None Spots Stripes Spots and stripes Patches	Scored by 11 separate respondents prior to survey.
Colouration High contrast colouration arguably affects the detectability of the species and thus it's ecological charisma, also likely to affect aesthetic charisma.	Single plain coloured Single bright Multi-coloured low-contrast Multi coloured high-contrast Black and white	Scored by 11 separate respondents prior to survey.

(continued on next page)

Table 2 (*continued*)

Attribute	Levels	References
Eye position Several authors have suggested that people are attracted to characteristics also found in human babies	Forwards Lateral	Lorenz and Gould in Sunquist (1992)
Fluffiness This attribute was included because fluffiness often appears to be associated with a species' 'cuteness' and thus might be linked to people's perceptions.	None Some Extreme	Scored by 11 separate respondents prior to survey.
Photo quality In an attempt to avoid bias caused by aesthetic differences in the photographs, all photos were scored for their aesthetic quality, irrespective of their subject species.	Poor Average Excellent	Scored by 11 separate respondents prior to survey.
Baldness Many seemingly unpopular species appear to have regions of baldness, such as their tail. This variable was intended to assess whether these bald patches had an effect on people's attitudes.	None Some Extreme	Scored by 11 separate respondents prior to survey.

Candidate models were evaluated by comparing differences in their second-order Akaike Information Criterion (AIC_C) values and Akaike weights (ω_i strength of evidence for each candidate model being best model of those fitted to the data). AIC considers both model fit and complexity, and finds models that most parsimoniously represent the strongest relationships. Models with the highest AIC weight identify the strongest relationships between explanatory and response variables, and an Akaike weight >0.9 indicates the presence of a single best model (Burnham and Anderson, 2002).However, when Akaike weights indicate there is no single best model, this was taken as an indication of uncertainty in model selection. Model averaging was used as a method of multi-model inference to calculate relative variable importance values from model combinations within 2 AIC_C units of the highest ranked model (Burnham and Anderson, 2002) and to provide model averaged parameter estimates of the strength of the relationship between each explanatory variable and the response.

Data collected from respondents in five countries in five continents (Australia, India, South Africa, UK, USA) were analysed collectively (all regions) and then separate full models were tested for each country's respondents in turn.

Many factors have the potential to influence people's perceptions of different species in addition to their physical attributes. For instance cultural biases may lead a species to be valued far more, or far less than we might expect from the physical characteristics alone. In order to gain an insight into these wider influences, we compared the predicted charisma scores for each species (calculated from the model averaged parameter estimates) with the actual preference scores from the survey to identify those species with the greatest residuals.

3. Results

3.1. Survey results and ranking

3.1.1. Species preference scores

When analysed across all regions, six of the ten top ranking species were members of the Felidae (with the jaguar (*Panthera onca*), black leopard and puma (*Puma concolor*) coming in at 11th,13th and 18th respectively). Furthermore, while the intervals between the species preference scores for those ranked second to tenth ranged from 0.002 to 0.095, the first ranked species, the tiger, had a margin of 0.227 over the second choice (see Table 3). The two lowest ranked mammals were both commensal rodents; the house mouse and the brown rat (*Rattus norvegicus*). The bottom ten animals also included various mammal morphs, including the striped skunk (*Mephitis mephitis*) and the star-nosed mole (*Condylura cristata*). Interestingly, there were three flying species in the list of ten lowest ranked mammals, two bats and the Malayan colugo (Appendix B).

Exploring its extraordinary pre-eminence, the tiger was seen by respondents a total of 774 times, of which it received a negative preference score (−1 or −2) 94 times against 61 different mammal images. When compared against the tiger, the Iberian lynx (*Lynx pardinus*) and the leopard performed best, each beating the tiger in four instances. The tiger received a score of −2 (i.e. the other mammal was 'preferred completely') a total of 31 times, beaten by 30 different images. Only the jaguar was completely preferred to the tiger more than once. Summing the scores received by each species when presented against the tiger, the leopard had the highest preference score (5) and the bilby (*Macrotis lagotis*), Iberian lynx, jaguar, Lar gibbon (*Hylobates lar*) and the northern hairy-nosed wombat (*Lasiorhinus krefftii*) were all tied in second place with a preference score of 4.

3.2. Regional variation in preference scores

Although the tiger was the most favoured species in all five regions, and the African elephant was ranked second in three of the five, there were intercontinental differences in the rankings (Table 3). There were no statistically significant

Table 3
The ten top ranked mammal species for each region and across all regions. A full list of species and their scores is provided in Appendix B.

Rank	Australia ($n = 303$)			India ($n = 310$)			South Africa ($n = 311$)			UK ($n = 305$)			USA ($n = 307$)			All regions ($n = 1536$)		
	Species	All regions rank	Average score	Species	All regions rank	Average score	Species	All regions rank	Average score	Species	All regions rank	Average score	Species	All regions rank	Average score	Species	All regions rank	Average score
1	Tiger	1	1.020	Tiger	1	1.135	Tiger	1	1.199	Tiger	1	1.318	Tiger	1	0.932	Tiger	1	1.124
2	Northern hairy-nosed wombat	16	0.993	Lion	3	0.854	African elephant	2	1.072	African elephant	2	1.035	African elephant	2	0.881	African elephant	2	0.897
3	Bornean orang-utan	10	0.952	Cheetah	4	0.819	Jaguar	12	0.982	Iberian lynx	9	0.850	Grevy's zebra	8	0.845	Lion	3	0.802
4	Western gorilla	5	0.922	African elephant	2	0.733	Cheetah	4	0.972	Leopard	6	0.842	Clouded leopard	7	0.830	Cheetah	4	0.782
5	Echidna	31	0.804	Wild Bactrian camel	21	0.673	Sumatran rhinoceros	14	0.967	Lion	3	0.833	Cheetah	4	0.819	Western gorilla	5	0.733
6	African elephant	2	0.779	Red panda	11	0.657	Lion	3	0.933	Western gorilla	5	0.818	Iberian lynx	9	0.771	Leopard	6	0.720
7	Red shanked douc	17	0.648	Bornean orang-utan	10	0.600	Leopard	6	0.894	Cheetah	4	0.778	Lion	3	0.765	Clouded leopard	7	0.718
8	Koala	22	0.646	Jaguar	12	0.553	Clouded leopard	7	0.882	Clouded leopard	7	0.770	Leopard	6	0.659	Grevy's zebra	8	0.684
9	Red panda	11	0.639	Leopard	6	0.553	Grevy's zebra	8	0.809	Red panda	11	0.727	Red wolf	15	0.659	Iberian Lynx	9	0.680
10	Leopard	6	0.638	Clouded leopard	7	0.543	Western gorilla	5	0.790	Black leopard	13	0.709	Western gorilla	5	0.638	Bornean orang-utan	10	0.644

Table 4
The relative variable importance for each attribute in each region, and across all regions.

Attribute	Australia	India	South Africa	UK	USA	All regions
Baldness	1	1	0.35	0.68	1	1
Body size	1	1	1	1	1	1
Human threat	1	0.88	1	1	–	1
IUCN status	1	1	1	1	1	1
Eye position	0.58	0.88	–	1	1	0.86
Facial markings	–	0.41	1	0.49	–	0.47
ED score	0.46	0.77	–	0.2	1	0.47
Diet	–	–	–	0.09	1	0.29
Striking appearance	–	0.35	0.21	0.15	0.27	0.28
Photo quality	–	–	–	0.38	0.2	0.09
Activity pattern	–	1	–	–	–	0.04
Colour	–	1	1	–	–	–
Armour	–	–	–	–	–	–
Body markings	–	–	–	–	–	–
Fluffiness	–	–	–	–	–	–

differences between nations in the actual preference scores (Friedman chi-squared = 0.44, df = 4, $p = 0.9791$) or ranked preferences (Friedman chi-squared = 0.5782, df = 4, $p = 0.9655$), but there were interesting anomalies amongst them.

The ranking in Australia was markedly different to all others, with a notable preference for their native species. Aside from the unshakable pre-eminence of the tiger, Australians ranked the northern hairy-nosed wombat at the top of their list (15 places higher than its overall ranking). Indeed, the largest departure from the overall ranking for any species was the Australian respondents' ranking of the echidna (*Zaglossus attenboroughi*; an endemic of Australia and New Guinea) that they ranked 26 places above its overall rank. Australians, uniquely, ranked the red-shanked douc langur (*Pygathrix nemaeus*) in their top ten (this, along with their third choice, the orang-utan (*Pongo pygmaeus*), is a South East Asian species), and they, together with the Indian respondents, also ranked the red panda (*Ailurus fulgens*) highly. Indians, uniquely, ranked the Bactrian camel (*Camelus ferus*) very highly, at fifth place, while South Africans that ranked the South American jaguar most highly, and indeed more highly than their local analogue, the leopard. South Africans, uniquely, included the Sumatran rhino (*Dicerorhinus sumatrensis*) in their top ten, at fifth place. The UK was the most felid-oriented sub-population, with seven species in their top 10, and the only country to place the Iberian lynx in its top three. Americans ranked clouded leopards (*Neofelis nebulosa*) more highly (fourth) than did any other sub-population, and ranked the Grevy's zebra more highly (third) than did any other group (in its native South Africa it was ranked ninth).

3.3. Preferences for attributes

We used an information-theoretic approach to compare models that related the various attributes to the average preference scores for each mammal.

When analysed across all regions, 17 models fell within 2AIC_c of the top model. These models included 11 out of our 15 attributes, with baldness, human threat, IUCN status and body size featuring in 100% of the top models, while eye position was also important with a relative variable importance of 0.86 (Table 4). The top model for all regions included the variables Baldness + Body size + Colour + Eye position + Facial marking + Human threat + IUCN, however its low Akaike weight ($\boldsymbol{\omega_i} = 0.1$) indicates that this model was not greatly superior to the other top models (Table 5). The evidence ratio indicates the top model was only 1.11 times better than the next highest ranked model, which does not include the terms for colouration or facial markings, but does include the variables ED score and diet. In addition, the top model was a less effective predictor of respondent preferences than the full model (Top model $\bar{R}^2 = 0.643$, full model adjusted $\bar{R}^2 = 0.805$). Across all regions respondents seemed to prefer species that had no baldness, that were in the largest size class, that were a single bright colour, had forward facing eyes, prominent facial markings, were potentially a threat to humans and were critically endangered. Species that had extensive baldness, were in the smallest size class, were black and white in colour, had lateral facing eyes, no facial markings, were not a human threat and were of least concern were the least favourable (full model averaged parameter estimates see Appendix C).

When analysing each region separately, 4 models fell within 2AIC_c of the top model in Australia. The top models included 6 out of our 15 attributes with baldness, human threat, IUCN status and body size featuring in all of the top models. The top model for Australia included the variables baldness + body size + eye position + human threat + IUCN, and was reasonably well supported compared to the other top models with an Akaike weight of 0.36. The evidence ratio shows the top model was 1.5 times better at explaining the variation in the Australian participants' response scores than the next highest ranked model, which included ED score instead of eye position. The $\bar{R}^2$ values for Australia were comparatively low, however they still showed reasonably good predictive power for both the top model and the full model (Top model $\bar{R}^2 = 0.691$, full model adjusted $\bar{R}^2 = 0.693$). Australian respondents seemed to prefer species that had no baldness, forward facing eyes, were a potential threat to humans, were critically endangered, in the largest size class and had a high evolutionary distinctiveness. Species that had extensive baldness, lateral facing eyes, were not a potential threat to humans, were of least concern for conservation, weighed between 20 and 40 kg and had an intermediate evolutionary distinctiveness were the least favourable.

Table 5
List of the strongest models produced by the model averaging analysis. Only models within 2ΔAIC_C of the top model are presented.

Model rank	Variables in model	AIC_C	ΔAIC_C	ω_i	Evidence ratio
Australia					
1	Baldness + Body size + Eye position + Human threat + IUCN	47.64	0.00	0.36	1.00
2	Baldness + Body size + ED score + Human threat + IUCN	48.49	0.85	0.24	1.50
3	Baldness + Body size + ED score + Eye position + Human threat + IUCN	48.62	0.98	0.22	1.64
4	Baldness + Body size + Human threat + IUCN	49.00	1.36	0.18	2.00
India					
1	Activity pattern + Baldness + Body size + Colour + ED score + Eye position + Human threat + IUCN	−13.48	0.00	0.24	1.00
2	Activity pattern + Baldness + Body size + Colour + ED score + Eye position + Facial marking + Human threat + IUCN	−12.82	0.66	0.17	1.41
3	Activity pattern + Baldness + Body size + Colour + ED score + Eye position + Human threat + IUCN + Striking	−12.16	1.32	0.12	2.00
4	Activity pattern + Baldness + Body size + Colour + ED score + Facial marking + Human threat + IUCN	−12.16	1.32	0.12	2.00
5	Activity pattern + Baldness + Body size + Colour + ED score + Eye position + IUCN	−12.12	1.36	0.12	2.00
6	Activity pattern + Baldness + Body size + Colour + Eye position + Facial marking + Human threat + IUCN + Striking	−12.09	1.39	0.12	2.00
7	Activity pattern + Baldness + Body size + Colour + Eye position + Human threat + IUCN + Striking	−11.87	1.61	0.11	2.18
South Africa					
1	Body size + Colour + Facial marking + Human threat + IUCN	29.93	0.00	0.44	1.00
2	Baldness + Body size + Colour + Facial marking + Human threat + IUCN	30.36	0.43	0.35	1.26
3	Body size + Colour + Facial marking + Human threat + IUCN + Striking	31.45	1.52	0.21	2.10
UK					
1	Baldness + Body size + Eye position + Facial marking + Human threat + IUCN	42.71	0.00	0.12	1.00
2	Baldness + Body size + Eye position + Human threat + IUCN	42.86	1.00	0.11	1.09
3	Body size + Eye position + Facial marking + Human threat + IUCN + Photo quality	43.37	1.02	0.08	1.50
4	Body size + Eye position + Facial marking + Human threat + IUCN	43.39	1.02	0.08	1.50
5	Baldness + Body size + ED score + Eye position + Human threat + IUCN + Photo quality	43.43	1.02	0.08	1.50
6	Baldness + Body size + ED score + Eye position + Human threat + IUCN	43.67	1.02	0.07	1.71
7	Baldness + Body size + Eye position + Human threat + IUCN + Photo quality	43.75	1.02	0.07	1.71
8	Body size + Eye position + Facial marking + Human threat + IUCN + Striking	43.78	1.03	0.07	1.71
9	Baldness + Body size + Eye position + Facial marking + Human threat + IUCN + Photo quality	44.07	1.03	0.06	2.00
10	Body size + ED score + Eye position + Human threat + IUCN + Photo quality	44.49	1.04	0.05	2.40
11	Baldness + Body size + Diet + Eye position + Human threat + IUCN	44.55	1.04	0.05	2.40
12	Baldness + Body size + Diet + Eye position + Facial marking + Human threat + IUCN	44.66	1.05	0.04	3.00
13	Body size + Eye position + Human threat + IUCN + Photo quality	44.69	1.05	0.04	3.00
14	Baldness + Body size + Eye position + Human threat + IUCN + Striking	44.70	1.05	0.04	3.00
15	Baldness + Body size + Eye position + Facial marking + Human threat + IUCN + Striking	44.71	1.05	0.04	3.00
USA					
1	Baldness + Body size + Diet + ED score + Eye position + IUCN	38.11	0.00	0.53	1.00
2	Baldness + Body size + Diet + ED score + Eye position + IUCN + Striking	39.44	1.03	0.27	1.96
3	Baldness + Body size + Diet + ED score + Eye position + IUCN + Photo quality	40.01	1.05	0.20	2.65
All regions					
1	Baldness + Body size + Colour + Eye position + Facial marking + Human threat + IUCN	3.29	0.00	0.10	1.00
2	Baldness + Body size + Diet + ED score + Eye position + Human threat + IUCN	3.48	1.06	0.09	1.11
3	Baldness + Body size + Colour + Facial marking + Human threat + IUCN	3.79	1.15	0.08	1.25

(continued on next page)

Table 5 (*continued*)

Model rank	Variables in model	AIC_C	ΔAIC_C	ω_i	Evidence ratio
4	Baldness + Body size + Colour + Eye position + Facial marking + Human threat + IUCN + Striking	3.95	1.20	0.07	1.43
5	Baldness + Body size + Colour + Eye position + Human threat + IUCN + Striking	4.06	1.23	0.07	1.43
6	Baldness + Body size + Colour + ED score + Eye position + Human threat + IUCN	4.18	1.27	0.07	1.43
7	Baldness + Body size + Colour + Diet + Eye position + Facial marking + Human threat + IUCN	4.40	1.34	0.06	1.67
8	Baldness + Body size + Colour + Facial marking + Human threat + IUCN + Striking	4.46	1.36	0.06	1.67
9	Baldness + Body size + Colour + Diet + ED score + Eye position + Facial marking + Human threat + IUCN	4.50	1.37	0.06	1.67
10	Baldness + Body size + ED score + Eye position + Human threat + IUCN + Photo quality	4.62	1.40	0.05	2.00
11	Baldness + Body size + Colour + Eye position + Human threat + IUCN	4.86	1.48	0.05	2.00
12	Activity pattern + Baldness + Body size + Colour + Eye position + Human threat + IUCN + Striking	5.09	1.55	0.04	2.50
13	Baldness + Body size + Diet + ED score + Eye position + Human threat + IUCN + Photo quality	5.11	1.55	0.04	2.50
14	Baldness + Body size + Colour + Diet + ED score + Eye position + Human threat + IUCN	5.12	1.56	0.04	2.50
15	Baldness + Body size + Colour + ED score + Eye position + Human threat + IUCN + Striking	5.24	1.59	0.04	2.50
16	Baldness + Body size + ED score + Eye position + Human threat + IUCN	5.27	1.60	0.04	2.50
17	Baldness + Body size + Colour + ED score + Eye position + Facial marking + Human threat + IUCN	5.28	1.60	0.04	2.50

For India, 7 models fell within $2AIC_c$ of the top model and included 10 attributes, of which the most important appeared to be activity pattern, baldness, body size, colour and IUCN status, although both eye position and human threat also had a high relative variable importance. The top model for India included the variables activity pattern + baldness + body size + colour + ED score + eye position + human threat + IUCN and was relatively well supported with an Akaike weight of 0.24 and having 1.4 times the support than the second highest ranked model, which included the facial markings variable, as well as all those in the top model. Both the full model and the top model performed well, and the difference between the $\bar{R}^2$ for the two models was small (Top model $\bar{R}^2 = 0.764$, full model adjusted $\bar{R}^2 = 0.801$). Indian respondents seemed to prefer species that had a nocturnal/crepuscular activity pattern, no baldness, that were a single bright colour, that were not evolutionarily distinct, had forward facing eyes, were a human threat, were critically endangered, in the largest size class, had prominent facial markings and were not 'striking' in appearance. Species that had some partial baldness, were in the smallest size class, were least concern, were crepuscular and had a black and white body were the least favoured.

For South Africa, 3 models fell within $2AIC_c$ of the top model and included 7 attributes, of which the most important appeared to be body size, colour, facial markings, human threat and IUCN status. The top model for South Africa included the variables body size + colour + facial marking + human threat + IUCN status and was relatively well supported with an Akaike weight of 0.44, although the top model was only 1.26 times better supported than the second highest model, which had an Akaike weight of 0.35 and included the term for baldness in addition to the variables in the top model. Both the full model and the top model performed well, and the difference between the $\bar{R}^2$ for the two models was small (Top model $\bar{R}^2 = 0.775$, full model adjusted $\bar{R}^2 = 0.820$). South African respondents seemed to prefer species that were a single bright colour, had prominent facial markings, were a potential human threat, were critically endangered, in the largest size class, had no baldness, and did not have a 'striking' appearance. Species in the smallest size class, that were not a human threat, were of least conservation concern, had no facial markings and had a black and white body were the least favoured.

For the UK, 15 models fell within $2AIC_c$ of the top model and included 10 attributes, of which the most important appeared to be body size, eye position, human threat and IUCN status. The top model for the UK included the variables baldness + body size + eye position + facial marking + human threat + IUCN but had a low Akaike weight of 0.12 suggesting that the top model did not greatly out perform other candidate models. Indeed, the evidence ratio revealed that the second ranked model was almost equally supported by the data (evidence ratio = 1.09). The second highest model differed from the top model only in the omission of the facial marking variable. The $\bar{R}^2$ values for the UK were comparatively low, however still showed reasonably good predictive power for both the top model and the full model (Top model $\bar{R}^2 = 0.661$, full model adjusted $\bar{R}^2 = 0.692$). UK respondents seemed to prefer species that had no baldness, forward facing eyes, prominent facial markings, were a potential threat to humans, were critically endangered, were in the largest size class, had excellent photo quality, were not evolutionarily distinct, did not have a 'striking' appearance, and that were herbivorous. Species weighing between 20 and 40 kg, that were not a human threat, were of least conservation concern and had lateral facing eyes were the least favoured.

Finally, 3 models were retained within $2AIC_c$ of the top model for the USA and included 8 attributes, of which the most important were baldness, body size, diet, ED score, eye position and IUCN status. The top model for the USA included the variables baldness + body size + diet + ED score + eye position + IUCN and was well supported with an Akaike weight of 0.53. The top model was almost twice as well supported as the second highest ranked model, which differed by the addition of the term of striking appearance. The difference between the $\bar{R}^2$ for the top model and the full model was small (Top model $\bar{R}^2 = 0.686$, full model adjusted $\bar{R}^2 = 0.710$). Americans seemed to prefer species that had no baldness, were carnivorous, were not evolutionarily distinct, had forward facing eyes, were critically endangered, were in the largest size class, were not striking in appearance and had excellent quality photos. Species with extensively bald, in the smallest size class, of least conservation concern, with laterally positioned eyes, intermediate evolutionary distinctiveness and a carnivorous/scavenging diet were the least favoured.

Baldness, body size, human threat, IUCN status and eye position were included in a high proportion of top models for each country individually as well as for all regions and so can be considered to have the most influence on people's attitudes. Armour, fluffiness and body markings did not feature in any of the top models and so appear to have very little effect on people's preferences.

Importantly, photo quality was not retained in any of the top models for Australia, India and South Africa, and had consistently low relative variable importance in the regions where it was retained. This suggests that our attempts to standardise the photos used in the survey were successful and that photo quality did not exert an excessive influence on people's preferences.

Finally, although our models contained a large number of predictor variables, the low standard errors relative to parameter estimates show that the models were not overparameterised (Appendix C).

3.4. The effects of affinity and familiarity

Across all regions, the correlation between the observed respondent rank and affinity is high ($t_{2,98} = 15.535, p < 0.001, r = 0.843$), and indeed one might expect these two rankings to be very similar insofar as the question we posed to generate the respondent rankings was "how strong is your personal preference for conservation" of the particular species being contrasted, whereas for affinity we asked them to distinguish on a 5 point scale from "I like it a lot" to "I do not like it at all". Although the two judgements are closely linked they are clearly different: the common squirrel monkey (*Saimiri sciureus*), for example, came joint 19th on the affinity scale, but only 50th on the respondent ranking and the giraffe (*Giraffa camelopardalis*) came third in affinity, but only 20th in the respondent rank, whereas both the clouded leopard and the Iberian lynx were liked rather less than they were ranked by respondents.

Respondent rank was also significantly correlated to familiarity ($t_{2,98} = 4.359, p < 0.001, r = 0.403$), although less strongly than to affinity. The red panda, for instance, is not very familiar to respondents yet they ranked it highly, whereas the red kangaroo (*Macropus rufus*) is very familiar but not ranked highly. Familiarity and affinity were also significantly and positively correlated, although again the strength of the correlation is much less than that between affinity and respondent rank ($t_{2,98} = 6.449, p < 0.001, r = 0.546$). However, there is a big discrepancy between the familiarity and affinity for some species, such as the red panda; respondents were not very familiar with this species, but liked it a great deal. The same applied markedly to the somewhat unfamiliar, but greatly liked clouded leopard and Iberian lynx.

3.5. Over and under performers

Across all regions, the koala, African elephant and red kangaroo were the top 'over performers' when comparing the results of the paired test than to the predicted charisma based on their physical attributes alone, while the African wild dog, aye-aye and African buffalo were the worst performers (Table 6). This raises fascinating questions about the drivers of charisma that were not encapsulated by our attributes. For instance, Australians seemed to display a strong preference for native Australian species with the koala, parma wallaby and red kangaroo all performing far better than expected, while invasive species such as the red fox did far worse than expected. In contrast the red fox did far better than expected in both the USA and South Africa.

4. Discussion

This study provides novel, valuable insights not only into which species people prefer for conservation, but also which attributes appear to influence those preferences. Cats – particularly large ones – appeared to have marked and striking appeal within our sample, with the tiger ranked as the most preferred species by a wide margin. Although the African elephant was ranked second overall, and 69 mammalian families were represented, six of the top ten selected species were from a single family, the Felidae. Following the tiger, these were the lion (3rd), cheetah (4th), leopard (6th), clouded leopard (7th) and Iberian lynx (9th). Furthermore, of the remaining four felids in the sample, all ranked highly, the jaguar 12th, black leopard 13th, puma 18th and caracal (*caracal caracal*) 39th. The appeal of felids to this sample of the public, in a conservation context, is overwhelming.

Despite our intention to focus our interest on the attitudes of a wide sample of society, the differences between each country taken individually, as well as compared to all regions combined illustrates how attitudes vary across the different

Table 6
Top 10 over and under performers for each region and all regions combined. Residuals are calculated from the difference between the predicted charisma score (calculated from the model averaged parameter estimates) and the actual survey response scores.

	Australia		India		South Africa		UK		USA		All countries	
	Species	Residuals	Species	Residuals	Species	Residuals	Species	Residuals	Species	Residuals	Species	Residuals
1	Koala	0.85	Parma wallaby	0.40	Koala	0.82	European hedgehog	0.62	Red fox	0.47	Koala	0.54
2	Parma wallaby	0.52	Reeves's muntjac	0.36	Dik-dik	0.57	African elephant	0.51	African elephant	0.47	African elephant	0.41
3	Red kangaroo	0.48	Red panda	0.33	Red fox	0.38	Koala	0.51	Eurasian beaver	0.47	Red kangaroo	0.39
4	Caracal	0.40	African elephant	0.32	Grevys zebra	0.38	Parma wallaby	0.48	Koala	0.45	Parma wallaby	0.36
5	Common squirrel monkey	0.38	Koala	0.29	African elephant	0.32	Reindeer	0.45	Black-tailed jackrabbit	0.43	Grevys zebra	0.30
6	African elephant	0.37	Wild Bactrian camel	0.29	Common ringtail possum	0.29	Clouded leopard	0.40	Numbat	0.42	Dik-dik	0.28
7	Indian giant squirrel	0.33	Black-tailed jackrabbit	0.22	Clouded leopard	0.28	Eurasian beaver	0.31	Golden lion tamarin	0.36	Numbat	0.27
8	Clouded leopard	0.33	Sunda pangolin	0.20	Caracal	0.27	Dik-dik	0.31	Clouded leopard	0.34	Reindeer	0.27
9	Bornean orang-utan	0.32	Yellow mongoose	0.20	Patagonian mara	0.26	Bornean orang-utan	0.29	Red kangaroo	0.33	Eurasian beaver	0.21
10	Western gorilla	0.30	Tiger	0.19	Numbat	0.25	Red panda	0.29	Puma	0.32	Clouded leopard	0.20
91	Red fox	−0.37	East African oryx	−0.21	Brown rat	−0.30	Striped skunk	−0.33	African buffalo	−0.30	Sumatran rhinoceros	−0.26
92	Wild Bactrian camel	−0.37	Warthog	−0.24	Raccoon	−0.30	Raccoon	−0.34	Echidna	−0.32	Brown rat	−0.26
93	Raccoon	−0.39	North American river otter	−0.25	African buffalo	−0.35	Bilby	−0.35	Striped skunk	−0.32	Raccoon	−0.27
94	Fossa	−0.44	Aardvark	−0.26	Spotted hyaena	−0.35	Sumatran rhinoceros	−0.36	Fossa	−0.32	Striped skunk	−0.27
95	Brown rat	−0.44	African wild dog	−0.27	European badger	−0.36	Malayan colugo	−0.43	Malayan tapir	−0.36	Malayan colugo	−0.33
96	Striped skunk	−0.46	Malayan tapir	−0.28	House mouse	−0.39	African wild dog	−0.43	Capybara	−0.38	Spotted hyaena	−0.34
97	Aye-aye	−0.47	Maned sloth	−0.28	Mandrill	−0.42	Fossa	−0.45	African wild dog	−0.38	Fossa	−0.35
98	House mouse	−0.52	Aye-aye	−0.31	Striped skunk	−0.43	African buffalo	−0.45	Diademed sifaka	−0.41	African buffalo	−0.35
99	Warthog	−0.54	African buffalo	−0.32	Bilby	−0.43	Brown rat	−0.49	Asian palm civet	−0.42	Aye-aye	−0.36
100	Spotted hyaena	−0.67	Bilby	−0.37	Malayan colugo	−0.52	Spotted hyaena	−0.50	Common brushtail possum	−0.52	African wild dog	−0.37

societies. In particular, it is more than likely that close proximity and the conflict that this often generates will have a profound impact on the attitudes of the people who have to live alongside large carnivores (Douglas and Veríssimo, 2013; Linnell et al., 2000). However, our sample is an interesting one because within each country it represents the perceptions of a computer literate middle class that increasingly dominates many societies and which, in particular, is likely to have opinions and a voice in societal choices about conservation. We will report on the sociological profile of these 1536 people elsewhere but suffice it to say that many reported that they were interested in nature, watched nature documentaries on TV and were members of environmental NGOs. In practice, conservation action is the result of policy formulated through a political process, and the perceptions we report are those of a class whose members are a vital constituent of that political process.

Each image was tagged with a visual scale of conservation concern based on five levels of the IUCN Red List scores. This attribute proved to be of key importance occurring in all top models for each country as well as in all regions combined. In almost all cases respondents predictably preferred rarer species compared to species of lesser conservation concern, the only partial exception was the USA whose respondents showed the same general pattern as in other regions except for ranking vulnerable species fractionally above endangered species. Although we expected the choices to be made by respondents largely on the basis of the appearance of the species, by providing the IUCN score that became an element of the image, we show that increasing rarity positively influenced preference for a mammal being selected. In a future experiment it would be revealing to compare ranks of the same species when the precariousness of its status was, or was not, disclosed.

In addition to IUCN status, body size was the only other variable to command such widespread influence, also occurring in all top models in all cases. Respondents unanimously had the strongest preference for species in the largest size class (>800 kg) and most regions broadly ascribed to the notion that 'bigger is better' although there was also often a slight preference for small species, leaving those species in the middle ground (20–40 kg) as the least popular. Australians however bucked this trend, and although they still had a strong preference for species in the largest size class, it was difficult to discern a clear pattern in their preferences towards the remaining size classes (Appendix C).

Of the remaining attributes, several others appeared to have wide, if not universal appeal. For instance, in all areas apart from the USA, our respondents were strongly influenced by the attribute of human threat, with a preference for species that might potentially be threatening. Similarly baldness was an important attribute in all cases except South Africa, with respondents routinely preferring species that had no bald areas to species with either some or extensive baldness. The least important variables were armour, body markings and fluffiness, none of which featured in any of the top models for any country. The remaining attributes explained some, but not much, of the variation in charisma scores. Importantly, photo quality did not have an excessive influence on people's decisions.

In general, our models are able to predict the preferences of respondents with surprising effectiveness. Examining the data from all regions together yielded models with weaker predictive power than when analysing the data separately for each country, however, the $\bar{R}^2$ values for all regions remain high. This simultaneously highlights the fact that while there may be some commonalities in people's preferences across regions, it also supports studies that show important differences between disparate groups of stakeholders (Bowen-Jones and Entwistle, 2002).

The similarities, and differences, amongst the five sub-populations of respondents raise intriguing puzzles. Why, for example, did the Indian survey respondents rank Parma wallabies so highly? Similarly, why did South Africans rank jaguars higher than did any other nation, perhaps confusing it, or eliding it, with native leopards? And why did they so favour Sumatran rhinoceros (perhaps in resonance with the much publicised catastrophic poaching of black and white rhinos currently rampant in their region). As a generalisation, the tendency of Australians to rank highly endemics of Australia and South East Asia, but their distaste of the invasive red fox (*Vulpes vulpes*; ranked 90th in Australia Vs 48th across all regions) revealed a parochialism/localism not so conspicuously apparent in the other four sub-populations. However, the European badger (*Meles meles*) was ranked (lowly) with remarkable consistency in Australia (81st), South Africa (85th) and the USA (82nd), but much higher (57th) in the UK where it features in children's stories and is the emblem of a major conservation NGO. In this study we identified a range of attributes that we thought would be important drivers of people's preferences, and the high $\bar{R}^2$ values achieved by our models is encouraging, however improving our understanding of the cultural cues that lead to these differences may be useful to conservation organisations working in these areas and is an area of future research.

The mismatches between the observed and predicted rankings go to the heart of evaluating charisma and presumably are largely explained by the blight or boon of reputation. It may be unsurprising that the koala, or the African elephant performed better in the survey results than would have been predicted from their attributes—both are already popular icons and frequently portrayed favourably in both the fiction and news media. Similarly, the spotted hyaena has an almost universally bad reputation and emerged as one of the worst performers across most regions. Understanding the cultural drivers of these over and under performers could be extremely valuable to conservation organisations in their marketing campaigns. Another fascinating example is the red fox which performed extraordinarily badly in Australia where it is invasive, despite appearing to perform above expectation in most other regions. Perhaps the European hedgehog's success in the UK is a legacy of Beatrix Potter's Mrs Tiggy Winkle? Indeed this success is confirmed by the fact that the European hedgehog was recently voted BBC Wildlife Magazine's national icon (Hoare, 2013).

A species' charisma is likely to influence greatly its capacity to engender public support or as a conservation icon, and for terrestrial mammals this influential capacity can be predicted with fair accuracy from a small set of attributes. However, there is extraordinary taxonomic inequality in the preferences of our respondents which reveals an almost complete pre-eminence of the big cats. While the popularity of these animals has always been obvious, the extent to which they are revealed to hold a wide subset of the public in their thrall emphasises their unequalled potential as ambassadors for conservation. Indeed, the big cats as a group scored so highly that we might think of them as one, *Felis felicis*, a globally powerful emblem and flagship for conservation. Our findings also identify species ripe for promotion to iconic roles. Amongst the felids, for example, while the clouded leopard was, unsurprisingly, not familiar to our respondents, they liked it greatly, and ranked it very highly in terms of their preferences. The link between familiarity and affinity suggests that public awareness campaigns might be an effective way of improving people's attitudes towards currently underrated species.

This preliminary exploration of the attributes that appear to drive people's preferences for terrestrial mammals raises questions with respect to both the species and the people judging them. In the light of this triumph of the felids, what explains the variation in their charisma within the family? Indeed, since both families are seemingly attractive, agile, intelligent, adaptable predators (with forward facing eyes), why do the cats appear so much more charismatic than the dogs? To what extent, and how most effectively, can a species' appeal to relevant sections of the public be improved and utilised? And what aspects of the public's circumstances, experience and sociology affect the perceptions that shaped their choices? For example, the favourites of Australians differed markedly from those of the other respondents, with a possible tendency to localism—what are the consequences for conservation in that region? Finally, several studies (Dickman, 2010; Veríssimo, 2013; Zimmermann et al., 2014) have highlighted the importance of the disconnect between people's attitudes and their actions, and so understanding how conservation NGOs can best utilise the results presented here will be of critical importance. The answers to all these questions have the potential to be assembled into an ever-more holistic approach to conservation marketing. While we discovered that a suite of 15 attributes can reliably predict mammalian charisma within our sample, we hope that further exploration of these traits will allow us to identify a subset of readily available criteria that can be used to predict charisma beyond the 100 mammals in this analysis. This lays the groundwork for a powerful tool for quantifying and understanding mammalian charisma, and determining which species are really likely to be effective flagships for conservation.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.gecco.2015.04.006.

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